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F02D 41/02
F02D 45/00
F02M 25/07

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(71)Applicant : DENSO CORP

(72)Inventor : MABUCHI MAMORU
MATSUMOTO HIRAKI

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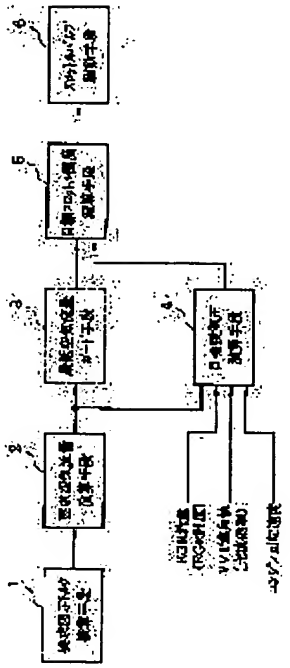
(54) CONTROLLER OF INTERNAL COMBUSTION ENGINE

(57)Abstract:

PROBLEM TO BE SOLVED: To accurately calculate the opening of a target throttle, even if there is variations in throttle opening-air flow characteristics due to variations in the production of a system.

SOLUTION: Based on the opening of an accelerator operated by an operator, a requested illustrated torque to be developed by the combustion of an internal combustion engine is calculated by a requested illustrated torque calculation means 1. Based on the requested illustrated torque, a requested air flow is calculated by a requested air flow calculation means 2, and based on the requested air flow, a target intake air pressure is calculated by a target intake air pressure calculation means 4. After the lower limit value of the requested air flow has been limited by a minimum air flow guard means 3, based on the requested air flow and the target intake air pressure, a target throttle opening is calculated by a target throttle opening calculation means 5. A throttle valve drive means 6 is controlled, so that the throttle opening matches the target throttle opening.



LEGAL STATUS

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[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of

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CLAIMS

[Claim(s)]
[Claim 1] In the control unit of the internal combustion engine having a target throttle opening operation means to calculate target throttle opening, and the throttle-valve driving means which drives a throttle valve based on said target throttle opening A demand illustration torque operation means to calculate the demand illustration torque which should be generated by an internal combustion engine's combustion based on the accelerator opening which the operator operated, A demand air-flow-rate operation means to calculate a demand air flow rate based on said demand illustration torque etc., It is the control unit of the internal combustion engine which has a target intake-pressure operation means to calculate a target intake pressure based on said demand air flow rate etc., and is characterized by said target throttle opening operation means calculating said target throttle opening based on said demand air flow rate and said target intake pressure.
[Claim 2] It is the control unit of the internal combustion engine according to claim 1 which has the adjustable valve timing device which carries out adjustable [of the exhaust air ring current control valve and/or valve timing which control the amount of exhaust air ring currents], and is characterized by said target intake-pressure operation means calculating said target intake pressure in consideration of said amount of exhaust air ring currents and/or said valve timing.
[Claim 3] The control unit of the internal combustion engine according to claim 1 or 2 characterized by having a minimum air-flow-rate guard means to restrict the lower limit of said demand air flow rate.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the control unit of the internal combustion engine carrying the so-called electronic throttle system which controls throttle opening electronically.
[0002]
[Description of the Prior Art] In this kind of internal combustion engine with an electronic throttle system (engine) In order to realize good drivability of the responsibility suitable for accelerator actuation of an operator For example, as shown in JP,10-103116,A, while calculating a demand air flow rate (air flow rate which should be supplied to an engine) using an inhalation-of-air system model An intake-pressure sensor detects an actual intake pressure (real intake pressure), and target throttle opening is calculated based on a demand air flow rate and a real intake pressure. He controls the motor which drives a throttle valve according to this target throttle opening, and is trying to make real throttle opening in agreement with target throttle opening.
[0003]
[Problem(s) to be Solved by the Invention] By the way, dispersion produces the air flow characteristics (refer to drawing 6) decided from throttle opening and an intake pressure by manufacture dispersion of a system etc. Since the real air flow rate which flows into an inlet manifold increases more than a demand air flow rate by this when dispersion occurs in the direction which an air flow rate increases by the same throttle opening as shown in drawing 7 for example, a real intake pressure becomes higher than an intake pressure in case there is no dispersion. Consequently, since an EGR flow rate (the amount of exhaust air ring currents) decreases and change of a real intake pressure is promoted, it becomes larger than the target throttle opening which the target throttle opening calculated using the real intake pressure calculated using the intake pressure in case there is no dispersion, and lapses into vicious circle that a real air flow rate increases more than a demand air flow rate increasingly by it. In short, if target throttle opening is calculated using a real intake pressure, target throttle opening will calculate in the direction which promotes dispersion in a real air flow rate further, and it will lapse into vicious circle that the control precision (throttle control precision) of the real air flow rate to a demand air flow rate falls increasingly.
[0004] This invention is made in consideration of such a situation, therefore target throttle opening can be calculated, without promoting the error by it, even if the purpose has dispersion (individual difference) in the throttle opening-air flow characteristics by manufacture dispersion of a system etc., and it is in offering the control unit of the internal combustion engine which can improve air control-of-flow precision (throttle control precision).
[0005]
[Means for Solving the Problem] While calculate the demand illustration torque which should generate by an internal combustion engine's combustion based on the accelerator opening which the operator operated with a demand illustration torque operation means 1 and calculating a demand air flow rate by the demand air-flow-rate operation means 2 based on this demand illustration torque etc. so that the control unit of the internal combustion engine of claim 1 of this invention may illustrate to drawing 1 in order to attain the above-mentioned purpose, a target intake pressure calculates by the target intake-pressure operation means 4 based on this demand air flow rate etc. And target throttle opening is calculated based on a demand air flow rate and a target intake pressure, the control signal according to this target throttle opening is outputted to the throttle-valve driving means 6, and it controls by the target throttle opening operation means 5 to make throttle opening in agreement with target throttle opening.
[0006] It takes into consideration that dispersion generates this invention in a real intake pressure by

dispersion in the throttle opening-air flow characteristics by manufacture dispersion of a system etc. Furthermore, the target intake pressure calculated based on a demand air flow rate etc. In case target throttle opening is calculated in consideration of not being influenced of dispersion in throttle opening-air flow characteristics, in order to calculate target throttle opening using a target intake pressure, without using a real intake pressure, Without promoting the error by it, even if dispersion is in throttle opening-air flow characteristics, target throttle opening can be calculated and air control-of-flow precision (throttle control precision) can be improved.
[0007] Moreover, when applying this invention to the system equipped with the adjustable valve timing device which carries out adjustable [of the exhaust air ring current control valve (EGR control valve) and/or valve timing (VVT tooth-lead-angle value) which control the amount of exhaust air ring currents (EGR flow rate)], it is good like claim 2 to calculate a target intake pressure in consideration of the amount of exhaust air ring currents, and/or valve timing. That is, the engine control parameter used as the factor which changes an intake pressure Since not only an air flow rate but the amount of exhaust air ring currents and valve timing become the factor which changes an intake pressure, in the system equipped with the exhaust air ring current control valve and/or the adjustable valve timing device Like claim 2, if a target intake pressure is calculated in consideration of the amount of exhaust air ring currents, and/or valve timing, a target intake pressure can be calculated in consideration of a part for the inhalation-of-air pressure change by the amount of exhaust air ring currents, and/or valve timing, and the operation precision of a target intake pressure can be improved.
[0008] By the way, if the air content inhaled in an internal combustion engine's cylinder decreases too much, the pressure in a cylinder becomes low too much, the phenomenon (henceforth an "oil sucking phenomenon") which sucks up an engine oil in a cylinder from the clearance between pistons occurs, and the increment in oil consumption and exhaust air emission aggravation may be caused.
[0009] As this cure, it is good like claim 3 for the minimum air-flow-rate guard means 3 (to refer to drawing 1) to restrict the lower limit of a demand air flow rate, and to calculate target throttle opening. If it does in this way, even when it will be the service condition from which it becomes possible from which to restrict the lower limit of a demand air flow rate within limits which an oil sucking phenomenon does not generate, and a demand air flow rate serves as the minimum, generating of an oil sucking phenomenon can be prevented and the problem of the increment in oil consumption by the oil sucking phenomenon and exhaust air emission aggravation can be solved.
[0010]
[Embodiment of the Invention] Hereafter, 1 operation gestalt which applied this invention to the injection type engine in a cylinder is explained based on a drawing.
[0011] First, based on drawing 2 , the outline configuration of the whole engine control system is explained. An air cleaner (not shown) is formed in the maximum upstream section of the inlet pipe 12 of the injection type engine 11 in a cylinder which is an injection type internal combustion engine in a cylinder, and the air flow meter 13 which detects an inhalation air content is formed in the downstream of this air cleaner at it. The throttle valve 15 by which opening accommodation is carried out by the motors 14 (throttle-valve driving means), such as a DC motor, is formed in the downstream of this air flow meter 13. The opening (throttle opening) of a throttle valve 15 is controlled by this motor 14 driving based on the output signal from the engine electronic control circuit (it being written as "ECU" below) 16, and the inhalation air content of each gas column HE is adjusted by that throttle opening by it.
[0012] A surge tank 17 is formed in the downstream of this throttle valve 15, and the intake-pressure sensor 18 which detects an intake pressure to this surge tank 17 is attached. The inlet manifold 19 which introduces air into each gas column of an engine 11 is connected to a surge tank 17, and the swirl control valve 20 for controlling the swirl style in the cylinder of an engine 11 is formed in the inlet manifold 19 of each gas column.
[0013] The fuel injection valve 21 which injects a fuel directly into a cylinder is attached in the upper part of each gas column of an engine 11, the fuel in a fuel tank 22 is pressurized by high pressure with a fuel pump 23, the fuel injection valve 21 of each gas column is supplied, and the pressure (fuel pressure) of the fuel is detected by the fuel-pressure sensor 24. An ignition plug 25 is attached in the cylinder head of an engine 11 for every gas column, and it is lit by the spark discharge of each point fire plug 25 at the gaseous mixture in a cylinder.
[0014] The intake valve 26 and the exhaust air bulb 27 of an engine 11 are driven with cam shafts 28 and 29, respectively, and the hydraulic adjustable valve timing device 30 which carries out adjustable [of the closing motion timing (VVT tooth-lead-angle value) of an intake valve 26] according to operational status

is formed in the cam shaft 28 of an inspired air flow path. The oil pressure which drives this adjustable valve timing device 30 is controlled by the hydraulic control valve 31. The rotation drive of the crankshaft 33 is carried out by the reciprocating motion of the piston 32 of each gas column of an engine 11, and auxiliary machinery 34 and a cars (compressor [of an air-conditioner], AC-dynamo, torque-converter, pump of power steering, etc.) drive system drive by the running torque of this crankshaft 33. The coolant temperature sensor 35 which detects cooling water temperature is attached in the cylinder block of an engine 11.

[0015] On the other hand, the catalysts 37, such as a three way component catalyst which purifies an exhaust gas, are formed in the exhaust pipe 36 of an engine 11, and the air-fuel ratio sensor 38 (or oxygen sensor) which detects the air-fuel ratio (or rich/Lean) of an exhaust gas to the upstream of this catalyst 37 is formed in it. Between the upstream of the air-fuel ratio sensor 38 of the exhaust pipes 36, and a surge tank 17, the EGR piping 39 for making a part of exhaust gas return to an inspired air flow path is connected, and EGR valve 40 (exhaust air ring current control valve) which controls the amount of exhaust air ring currents (the amount of EGR(s)) is formed while being this EGR piping 39.

[0016] ECU16 which controls an engine-operation condition is constituted considering a microcomputer as a subject, is performing the throttle control program of drawing 3 memorized by the ROM (storage), and realizes each function of the demand illustration torque operation means 1 shown in drawing 1 , the demand air-flow-rate operation means 2, the minimum air-flow-rate guard means 3, the target intake-pressure operation means 4, and the target throttle opening operation means 5.

[0017] The demand illustration torque operation means 1 computes demand illustration torque based on the output of the accelerator sensor 41 which detects the opening (accelerator opening) of an accelerator pedal etc. Here, demand illustration torque is the desired value (desired value) of illustration torque, and illustration torque is the torque generated by combustion of an engine 11, i.e., torque including the internal loss torque and external load loss torque (load of auxiliary machinery 34) of an engine 11. Therefore, the torque which deducted the internal loss torque and the external load loss torque from illustration torque turns into output torque (net torque) taken out from a crankshaft 33, and a car drive system drives it with this output torque.

[0018] the demand illustration torque operation means 1 -- the output (accelerator opening) of the accelerator sensor 41, and engine speed Ne etc. -- being based -- a map or a formula -- demand output-torque Tdrv -- computing -- this demand output-torque Tdrv various kinds of loss-torque Tloss(es) (interior loss-torque [of =] + external load loss torque) -- adding -- demand illustration torque Tind It asks (Tind =Tdrv+Tloss).

[0019] Here, internal loss torques are machine friction loss and pumping loss, and machine friction loss is an engine speed Ne. It is computed by a map or the formula based on the cooling water temperature THW, and pumping loss is an engine speed Ne. It is computed by a map or the formula based on an intake pressure Pm. Moreover, an external load loss torque is the loads (compressor [of an air-conditioner], AC-dynamo, pump of power steering, etc.) torque of the auxiliary machinery 34 driven under the power of an engine 11, and is computed according to an air-conditioner signal, the load current of an AC dynamo, etc.

[0020] In addition, demand illustration torque Tind In case it calculates, a part for the torque increase and decrease by idle speed control (ISC control) is amended, and it is the demand illustration torque Tind. It is made to ask or the loss and loads other than the above may be added, or some of loss and loads are disregarded from an above-mentioned internal loss and an above-mentioned external load, and you may make it simplify data processing on the contrary.

[0021] On the other hand, the demand air-flow-rate operation means 2 is the demand illustration torque Tind calculated with the demand illustration torque operation means 1. Engine speed Ne It is based and the demand air flow rate Gareq is calculated with a map or a formula.

[0022] Moreover, the minimum air-flow-rate guard means 3 calculates the minimum air flow rate Gamin used for restricting the lower limit of the demand air flow rate Gareq by the degree type.
Gamin=etaxVc xPm xNe/(120xRxTo)
eta: Charging efficiency Vc : Cylinder capacity Pm : Intake pressure Ne : Engine-speed R: Gas constant To : This minimum air flow rate Gamin plays a role of a minimum guard value for preventing that the oil sucking phenomenon by the extreme fall of cylinder internal pressure occurs whenever [large atmospheric temperature].

[0023] And the minimum air-flow-rate guard means 3 measures with the minimum air flow rate Gamin the demand air flow rate Gareq calculated with the demand air-flow-rate operation means 2, and is the final demand air flow rate Gacylreq about the larger one of the demand air flow rate Gareq and the minimum air flow rates Gamin. It chooses by carrying out.

[0024] Gacylreq =max(Gareq,Gamin)

That is, in Gareq>=Gamin, in Gacylreq =GareqGareq<Gamin, it can Gacylreq-=-Gamin-come, is alike, and is the more final demand air flow rate Gacylreq. A lower limit is restricted by the minimum air flow rate Gamin (guard processing).

[0025] On the other hand, the demand air flow rate Gareq, the EGR flow rate Megr, an engine speed Ne, charging-efficiency etaVol, atmospheric temperature To, cylinder capacity Vc, a gas constant R, etc. are used for the target intake-pressure operation means 4, and it is the target intake pressure Pmtg by the degree type. It calculates (refer to drawing 4).

Pmtg = (120/Ne) -(R-To/Vc)-(1/etaVol)- (Gareq+Megr)

Here, (Gareq+Megr) is the EGR flow rate Megr to the demand air flow rate Gareq. It is the added air flow rate and is equivalent to the air flow rate which flows the inside of an inlet manifold 19 and flows in a cylinder.

[0026] Moreover, as shown in drawing 5 , it is the EGR flow rate Megr. EGR opening thetaegr, an intake pressure Pm, exhaust gas pressure Pe, and exhaust-gas temperature Te It uses and calculates by the degree type.

Megr =g (thetaegr) and Pe/rootTe and phi (Pm/Pe)

[0027] Here, g (thetaegr) is EGR opening thetaegr. It is the flow rate characteristic value which it responds and is calculated on the map of EGR opening-EGR flow characteristics. Moreover, phi (Pm/Pe) is an intake pressure Pm. Exhaust gas pressure Pe It is the pressure characteristic value calculated on a map etc. according to a ratio. In addition, with the system of drawing 4 , it is an intake pressure Pm. Target intake pressure Pmtg Although first-order-lag processing is carried out and he is trying to ask, you may make it use the detection value (real intake pressure) of the intake-pressure sensor 18.

[0028] Moreover, charging-efficiency etaVol Engine speed Ne Intake pressure Pm It is based and calculates on a map. Under the present circumstances, inhalation-of-air valve timing (VVT tooth-lead-angle value) is also taken into consideration, and it is charging-efficiency etaVol. You may make it calculate.

[0029] on the other hand -- the target throttle opening operation means 5 -- demand air flow rate Gacylreq Target intake pressure Pmtg etc. -- it is based and the target throttle opening Tthtg is calculated as follows.

[0030] First, the demand air flow rate Gacylreq, the target intake pressure Pmtg, and atmospheric pressure force Po It is based and the air flow-characteristics value f (Thr) is calculated by the degree type.

[0031]

[Equation 1]

$$f(\mathrm{Thr}) = \frac{\mathrm{Gacylreq} \cdot \sqrt{\mathrm{To}}}{\Phi\left(\frac{\mathrm{Pmtg}}{\mathrm{Po}}\right) \cdot \mathrm{Po}}$$

[0032] Here, phi (Pmtg/Po) is the target intake pressure Pmtg. Atmospheric pressure force Po It is the pressure characteristic value calculated on a map etc. according to a ratio. And based on the air flow-characteristics value f (Thr), the target throttle opening Tthtg is calculated on the reverse property map of throttle opening-air flow characteristics.

[0033] Processing which calculates the target throttle opening Thrtg by the approach explained above is performed by the throttle control program shown in drawing 3 . This program is performed by ECU16 for every predetermined time and every predetermined crank angle. If this program is started, they are accelerator opening and an engine speed Ne at step 101 first. It is based and is demand output-torque Tdrv by the map or the formula. It calculates. Under the present circumstances, other service conditions, such as the vehicle speed, are taken into consideration, and it is demand output-torque Tdrv. You may make it calculate.

[0034] And at the following step 102, an internal loss torque (machine friction loss, pumping loss) and an external load loss torque (load torque, such as a compressor of an air-conditioner, an AC dynamo, and a pump of power steering) are calculated, and loss-torque Tloss which totaled them is calculated. Interior loss-torque [of Tloss=] + external load loss torque [0035] Then, it progresses to step 103 and is demand output-torque Tdrv. Loss-torque Tloss is added and it is the demand illustration torque Tind. It asks.

Tind =Tdrv+Tloss [0036] And it is the demand illustration torque Tind at the following step 104. Engine speed Ne After being based and calculating the demand air flow rate Gareq with a map or a formula, it progresses to step 105 and is an engine speed Ne. Intake pressure Pm It is based and is charging-efficiency etaVol. It calculates on a map. Under the present circumstances, inhalation-of-air valve timing (VVT tooth-lead-angle value) is also taken into consideration, and it is charging-efficiency etaVol. You may make it calculate.

[0037] Then, it progresses to step 106 and they are EGR opening thetaegr, exhaust gas pressure Pe, an intake pressure Pm, and an exhaust-gas temperature Te. It uses and is the EGR flow rate Megr by the degree type. It calculates.

Megr =g (thetaegr) and Pe/rootTe and phi (Pm/Pe)

Under the present circumstances, the flow rate characteristic value g (thetaegr) is EGR opening thetaegr. It responds, and calculates on the map of EGR opening-EGR flow characteristics, and the pressure characteristic value phi (Pm/Pe) is an intake pressure Pm. Exhaust gas pressure Pe According to a ratio, it calculates on a map etc.

[0038] In addition, intake pressure Pm used at the above-mentioned step 105,106 Target intake pressure Pmtg Although first-order-lag processing is carried out and you may make it ask, you may make it use the detection value (real intake pressure) of the intake-pressure sensor 18.

[0039] And the demand air flow rate Gareq, the EGR flow rate Megr, an engine speed Ne, charging-efficiency etaVol, atmospheric temperature To, cylinder capacity Vc, a gas constant R, etc. are used at the following step 107, and it is the target intake pressure Pmtg by the degree type. It calculates (refer to drawing 4).

Pmtg = (120/Ne) -(R-To/Vc)-(1/etaVol)- (Gareq+Megr)

[0040] Then, it progresses to step 108 and the minimum air flow rate Gamin used in order to restrict the lower limit of the demand air flow rate Gareq is calculated by the degree type using an engine speed Ne, an intake pressure Pm, atmospheric temperature To, and a charging efficiency eta.

Gamin=etaxVc xPm xNe/(120xRxTo)

[0041] And the demand air flow rate Gareq calculated at said step 104 is measured with the minimum air flow rate Gamin, and it is the final demand air flow rate Gacylreq about the larger one of the demand air flow rate Gareq and the minimum air flow rates Gamin. It chooses by carrying out. Demand air flow rate Gacylreq final by this A lower limit is restricted by the minimum air flow rate Gamin (guard processing).

[0042] Then, it progresses to step 109 and is the demand air flow rate Gacylreq. Based on the target intake pressure Pmtg etc., the target throttle opening Tthtg is calculated as follows. First, the demand air flow rate Gacylreq, the target intake pressure Pmtg, and atmospheric pressure force Po It is based and the air flow-characteristics value f (Thr) is calculated. Then, based on this air flow-characteristics value f (Thr), the target throttle opening Tthtg is calculated on the reverse property map of throttle opening-air flow characteristics.

[0043] And the control signal according to this target throttle opening Tthtg is outputted to a motor 14, and it controls by the following step 110 to make throttle opening in agreement with the target throttle opening Tthtg.

[0044] With this operation gestalt explained above, it takes into consideration that dispersion occurs in a real intake pressure by dispersion in the throttle opening-air flow characteristics by manufacture dispersion of a system etc. furthermore, demand air flow rate Gacylreq etc. -- target intake pressure Pmtg based and calculated It takes into consideration not being influenced of dispersion in throttle opening-air flow characteristics. It is the target intake pressure Pmtg, without using a real intake pressure, in case the target throttle opening Tthtg is calculated. In order to use and to calculate the target throttle opening Tthtg, Without promoting the error by it, even if dispersion is in throttle opening-air flow characteristics, the target throttle opening Tthtg can be calculated and air control-of-flow precision (throttle control precision) can be improved.

[0045] And at this operation gestalt, it is the EGR flow rate Megr. It takes into consideration becoming the factor which changes an intake pressure, and is the EGR flow rate Megr. Target intake pressure Pmtg Since it was made to incorporate into operation expression, it is the EGR flow rate Megr. A part for the inhalation-of-air pressure change to depend is taken into consideration, and it is the target intake pressure Pmtg. It can calculate and is the target intake pressure Pmtg. Operation precision can be improved.

[0046] In addition, target intake pressure Pmtg Charging-efficiency etaVol contained in operation expression In case it calculates, inhalation-of-air valve timing (VVT tooth-lead-angle value) is also taken into consideration, and it is charging-efficiency etaVol. If it is made to calculate, a part for the inhalation-of-air pressure change by inhalation-of-air valve timing will also be taken into consideration, and it is the target intake pressure Pmtg. It can calculate and is the target intake pressure Pmtg. Operation precision can be improved further. Moreover, the amount of purges of evaporated gas is also taken into consideration with the engine equipped with the EBAPO purge system which purges the evaporated gas (evaporative gas) which adsorbed in the canister in an inhalation-of-air system, and it is the target intake pressure Pmtg. If it is made to calculate, a part for the inhalation-of-air pressure change by the purge of evaporated gas will also be taken into consideration, and it is the target intake pressure Pmtg. It can calculate with a sufficient precision.

[0047] By the way, if the air content inhaled in the cylinder of an engine 11 decreases too much, the pressure in a cylinder becomes low too much, the phenomenon (oil sucking phenomenon) which sucks up an engine oil in a cylinder from the clearance between pistons occurs, and the increment in oil consumption and exhaust air emission aggravation may be caused.

[0048] As this cure, it is the demand air flow rate Gacylreq at this operation gestalt. Since a lower limit is restricted by the minimum air flow rate Gamin and the target throttle opening Tthtg was calculated Demand air flow rate Gacylreq It becomes possible to restrict a lower limit within limits which an oil sucking phenomenon does not generate. Demand air flow rate Gacylreq Even when it is a service condition used as the minimum, generating of an oil sucking phenomenon can be prevented and the problem of the increment in oil consumption by the oil sucking phenomenon and exhaust air emission aggravation can be solved.

[0049] In addition, with this operation gestalt, although it has both the adjustable valve timing device and the EGR system, with the application of this invention, it can carry out also in an engine without the system of one of the two of these, or both.

[0050] In addition, it cannot be overemphasized that it changes variously that this invention is not limited to the injection type engine in a cylinder, but is applied also to the suction-port injection type engine carrying an electronic throttle system, and can be carried out etc., and can carry out.

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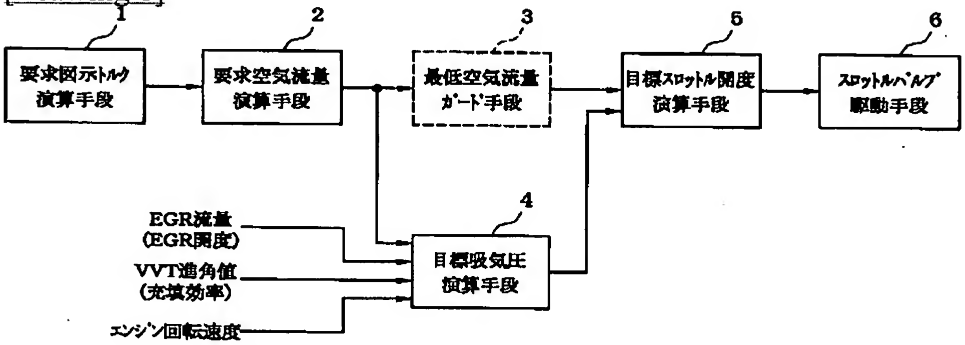
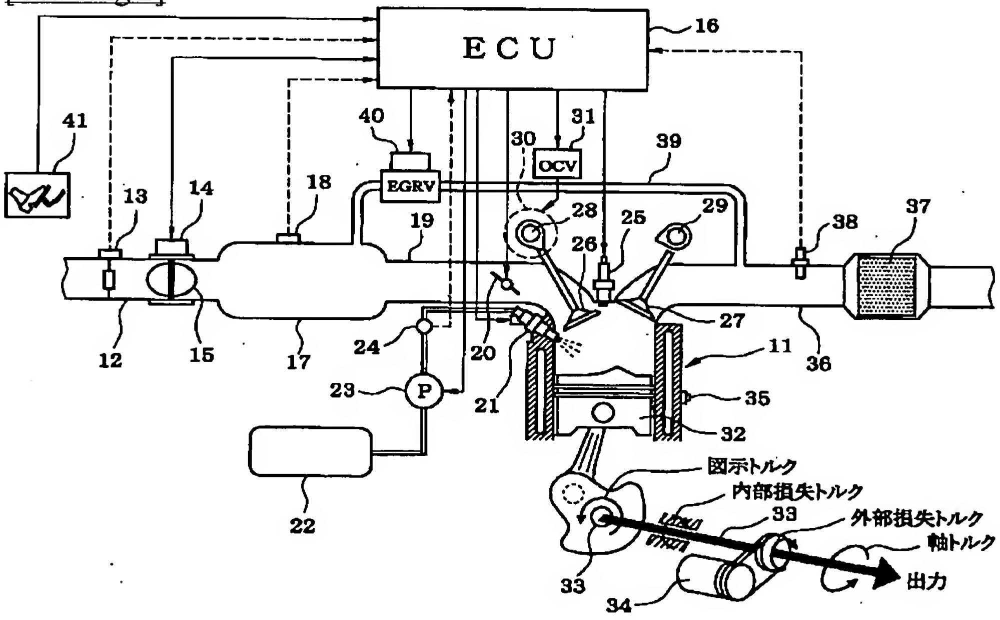
DRAWINGS

[Drawing 1]


1
要求図示ﾄﾙｸ演算手段
2
要求空気流量演算手段
3
最低空気流量ｶﾞｰﾄﾞ手段
5
目標ｽﾛｯﾄﾙ開度演算手段
6
ｽﾛｯﾄﾙﾊﾞﾙﾌﾞ駆動手段
4
目標吸気圧演算手段
EGR流量（EGR開度）
VVT進角値（充填効率）
ｴﾝｼﾞﾝ回転速度

[Drawing 2]


ECU
16
41
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EGRV
OCV
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19
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38
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12
15
17
24
20
27
11
36
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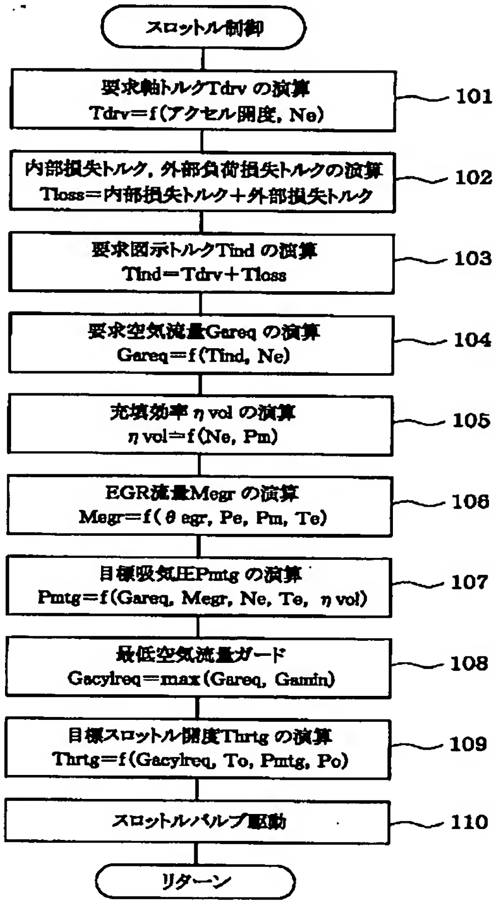
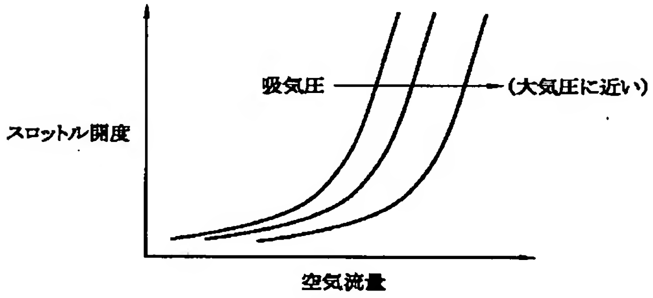
P
21
35
32
22
図示ﾄﾙｸ
内部損失ﾄﾙｸ
33
外部損失ﾄﾙｸ
軸ﾄﾙｸ
出力
33
34

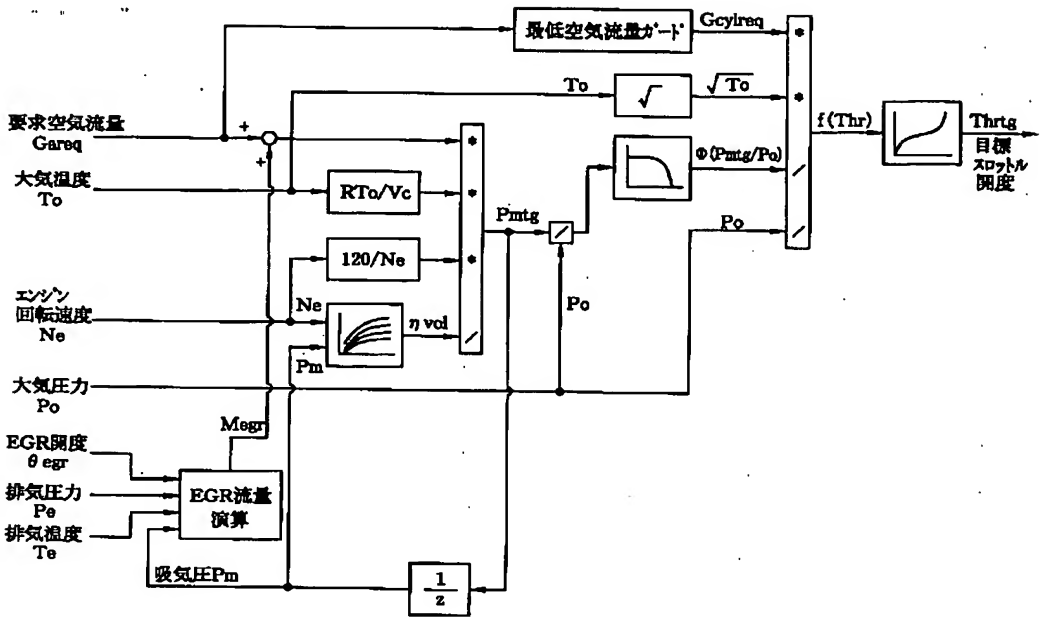
[Drawing 3]


スロットル制御
要求軸トルクTdrv の演算
Tdrv=f(アクセル開度, Ne)
101
内部損失トルク, 外部負荷損失トルクの演算
Tloss=内部損失トルク+外部損失トルク
102
要求図示トルクTind の演算
Tind=Tdrv+Tloss
103
要求空気流量Gareq の演算
Gareq=f(Tind, Ne)
104
充填効率 η vol の演算
η vol=f(Ne, Pm)
105
EGR流量Megr の演算
Megr=f(θ egr, Pe, Pm, Te)
106
目標吸気圧Pmtg の演算
Pmtg=f(Gareq, Megr, Ne, Te, η vol)
107
最低空気流量ガード
Gacylreq=max(Gareq, Gamin)
108
目標スロットル開度Thrtg の演算
Thrtg=f(Gacylreq, To, Pmtg, Po)
109
スロットルバルブ駆動
110
リターン

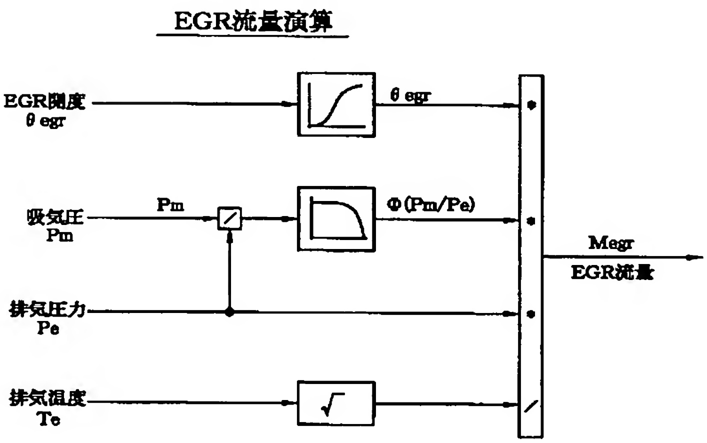
[Drawing 6]



[Drawing 4]

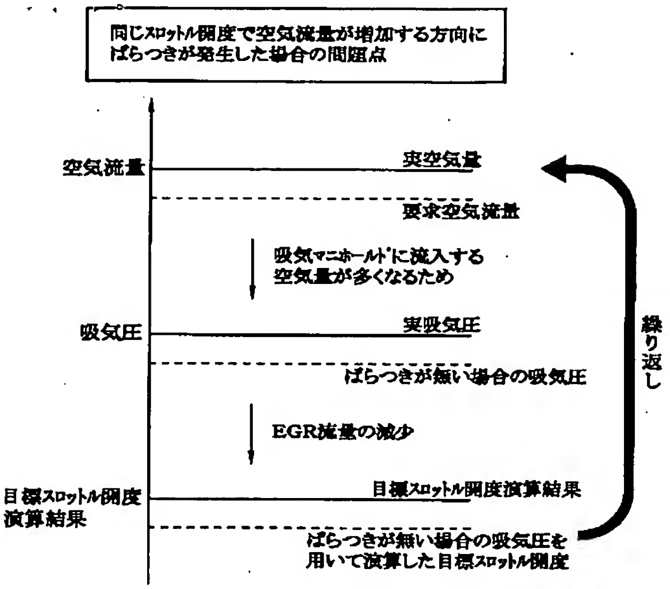

要求空気流量
Gareq
大気温度
To
エンジン
回転速度
Ne
大気圧力
Po
EGR開度
θ egr
排気圧力
Pe
排気温度
Te
最低空気流量ガード
Gcylreq
To
√To
RTo/Vc
120/Ne
Ne
η vol
Pm
Pmtg
Φ(Pmtg/Po)
Po
f(Thr)
Thrtg
目標
スロットル
開度
Megr
EGR流量
演算
吸気圧Pm
1
z

[Drawing 5]


EGR流量演算
EGR開度
θ egr
θ egr
吸気圧
Pm
Pm
Φ(Pm/Pe)
排気圧力
Pe
排気温度
Te
Megr
EGR流量

$$Megr = g(\theta egr) \cdot \frac{Pe}{\sqrt{Te}} \cdot \Phi\left(\frac{Pm}{Pe}\right)$$

[Drawing 7]


同じｽﾛｯﾄﾙ開度で空気流量が増加する方向に
ばらつきが発生した場合の問題点
空気流量
実空気量
要求空気流量
吸気ﾏﾆﾎｰﾙﾄﾞに流入する
空気量が多くなるため
吸気圧
実吸気圧
ばらつきが無い場合の吸気圧
EGR流量の減少
目標ｽﾛｯﾄﾙ開度
演算結果
目標ｽﾛｯﾄﾙ開度演算結果
ばらつきが無い場合の吸気圧を
用いて演算した目標ｽﾛｯﾄﾙ開度
繰り返し

[Translation done.]